DISPERSION AND CHARACTERISTICS OF WAVES IN FUNCTIONALLY GRADED PIEZOELECTRIC CYLINDERS

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An analytical-numerical method is presented to analyze the dispersion and characteristics of waves in functionally graded piezoelectric material (FGPM) cylinders. In this method, the FGPM cylinder is divided into a number of annular elements with three-nodal-lines in the wall thickness. The elemental mechanical as well as electrical properties are assumed to vary linearly in the thickness direction so as to better model the spatial variation of the mechanical and electrical properties of FGPM. The Hamilton principle is applied to determine the governing equations. The phase velocity surface (PVS), phase slowness surface (PSS), phase wave surface (PWS), group velocity surface (GVS), group slowness surface (GSS), and group wave surface (GWS) for FGPM cylinders are defined and their formulations are deduced from the Rayleigh quotient of the eigenvalues of the eigenvalue equations. The six surfaces can be used to illustrate the characteristics of the plane waves and waves generated from a point source in FGPM cylinders. The calculation examples provide a full understanding for the complex phenomena of elastic waves in FGPM cylinders.

References

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